## **CLAIMS**

1. A method for analyzing a three dimensional region of interest relative to a predetermined event, the method comprising the steps of:

defining a boundary of the event;

defining the region of interest relative to the boundary of the event;

selecting a first attribute and a second attribute, the first attribute and second attribute representing the region of interest;

calculating a first attribute volume and a second attribute volume for the region of interest, the first attribute volume and the second attribute volume each comprising a plurality of voxels, each voxel being defined by a set of x,y,z coordinates and a data value;

selecting a first set of voxels from the first attribute volume that have a data value within a first attribute data value range, the first set of voxels representing a preferred feature of the region of interest;

selecting a second set of voxels from the second attribute volume that have a data value within a second attribute data value range, the second set of voxels representing the preferred feature; and

imaging the first set of voxels and the second set of voxels.

- 2. The method of Claim 1, wherein the preferred feature substantially comprises gas-bearing sand or sandstone.
- 3. The method of Claim 2, wherein the first attribute represents an acoustic signal comprising instantaneous amplitude and the second attribute represents an acoustic signal comprising instantaneous frequency.
- 4. The method of Claim 3, wherein the region of interest is defined as within about 300 feet from the boundary of the event.
- 5. The method of Claim 3, wherein the first attribute data value range is between about 10 and about 140, and the second attribute data value range is between about 0 and about 48, the first attribute data value range and the second attribute data value range being measured on a voxel scale between about 0 and about 255.
- 6. The method of Claim 5, wherein the first attribute data value range is between about 37 and about 110, and the second attribute data value range is between about 2 and about 36.
- 7. The method of claim 5, wherein the first attribute data value range is between about 37 and about 120, and the second attribute data value range is between about 2 and about 36.
- 8. The method of claim 5, wherein the first attribute data value range is between about 37 and about 130, and the second attribute data value range is between about 3 and about 37.

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9. The method of Claim 1, wherein defining the boundary of the event comprises the steps of:

selecting a third attribute, the third attribute representing the event;

calculating a third attribute volume for the event, the third attribute volume comprising a plurality of voxels, each voxel being defined by a set of x,y,z coordinates and a data value;

selecting a third set of voxels from the third attribute volume that have a data value within a third attribute data value range, the third set of voxels representing the boundary of the event; and

imaging the third set of voxels.

- 10. The method of Claim 9, wherein the event is a geological formation substantially comprising at least dolomite or limestone.
- 11. The method of Claim 10, wherein the third attribute represents an acoustic signal comprising at least one of amplitude, phase, frequency, instantaneous amplitude, instantaneous phase, instantaneous frequency, coherence and semblance.
- 12. The method of Claim 11, wherein the third attribute data value range is between at least one of about 50 and about 127 and about -5 and about +5, the third attribute data value range being measured on a voxel scale between at least one of about 0 and about 255 and about -128 and about +127.

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13. The method of Claim 12, wherein imaging the third set of voxels comprises the steps of:

selecting a voxel from the third set of voxels, the selected voxel representing a seed voxel;

autopicking voxels from the third set of voxels that are connected to the seed voxel and have the same data value; and

displaying the autopicked voxels from the third set of voxels to a user.

14. The method of Claim 12, wherein imaging the third set of voxels comprises the steps of:

assigning a new data value to each voxel in the third set of voxels, the new data value having the same data value within a new data value range between about 0 and about 127;

selecting a voxel from the third set of voxels, the selected voxel representing a seed voxel;

autopicking voxels from the third set of voxels that are connected to the seed voxel and have the same data value; and

displaying the autopicked voxels from the third set of voxels to a user.

15. The method of claim 1, wherein imaging the first set of voxels and the second set of voxels comprises the steps of:

combining the first set of voxels and the second set of voxels to form a combined set of voxels representing the preferred feature, each voxel in the combined set of voxels being assigned a new data value, the new data value having the same data value within a combined data value range between about 0 and about 127;

selecting a voxel from the combined set of voxels, the selected voxel representing a seed voxel;

autopicking voxels from the combined set of voxels that are connected to the seed voxel and have the same data value; and

displaying the autopicked voxels from the combined set of voxels to a user.

16. The method of claim 1, wherein imaging the first set of voxels and the second set of voxels comprises the steps of:

selecting a voxel from at least one of the first set of voxels and the second set of voxels, the selected voxel representing a seed voxel;

autopicking voxels from the first set of voxels that are connected to the seed voxel and have the same data value;

autopicking voxels from the second set of voxels that are connected to the seed voxel and have the same data value; and

displaying the autopicked voxels from the first set of voxels and the second set of voxels to a user.

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17. A system comprising a program storage device readable by a machine, the storage device embodying a program of instructions executable by the machine for analyzing a 3-D region of interest relative to a predetermined event, the instructions comprising the steps of:

defining a boundary of the event;

defining the region of interest relative to the boundary of the event.

selecting a first attribute and a second attribute, the first attribute and second attribute representing the region of interest;

calculating a first attribute volume and a second attribute volume for the region of interest, the first attribute volume and the second attribute volume each comprising a plurality of voxels, each voxel being defined by a set of x,y,z coordinates and a data value;

selecting a first set of voxels from the first attribute volume that have a data value within a first attribute data value range, the first set of voxels representing a preferred feature of the region of interest;

selecting a second set of voxels from the second attribute volume that have a data value within a second attribute data value range, the second set of voxels representing the preferred feature; and

imaging the first set of voxels and the second set of voxels.

- 18. The system of claim 17, wherein the region of interest is a geological formation and the preferred feature substantially comprises at least sand or sandstone.
- 19. The system of claim 18, wherein the first attribute represents an acoustic signal comprising instantaneous amplitude and the second attribute represents an acoustic signal comprising instantaneous frequency.
- 20. The system of claim 19, wherein the region of interest is defined as within about 300 feet from the boundary of the event.
- 21. The system of claim 19, wherein the first attribute data value range is between about 10 and about 140, and the second attribute data value range is between about 0 and about 48, the first attribute data value range and the second attribute data value range being measured on a voxel scale between about 0 and about 255.
- 22. The system of claim 21, wherein the first attribute data value range is between about 37 and about 110, and the second attribute data value range is between about 2 and about 36.
- 23. The system of claim 21, wherein the first attribute data value range is between about 37 and about 120, and the second attribute data value range is between about 2 and about 36.
- 24. The system of claim 21, wherein the first attribute data value range is between about 37 and about 130, and the second attribute data value range is between about 3 and about 37.

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25. The system of claim 17, wherein defining the boundary of the event comprises the steps of:

selecting a third attribute, the third attribute representing the event;

calculating a third attribute volume for the event, the third attribute volume comprising a plurality of voxels, each voxel being defined by a set of x,y,z coordinates and a data value;

selecting a third set of voxels from the third attribute volume that have a data value within a third attribute data value range, the third set of voxels representing the boundary of the event; and

imaging the third set of voxels.

- 26. The system of claim 25, wherein the event is a geological formation substantially comprising dolomite or limestone.
- 27. The system of claim 26, wherein the third attribute represents an acoustic signal comprising at least one of amplitude, phase, frequency, instantaneous amplitude, instantaneous phase, instantaneous frequency, coherence and semblance.
- 28. The system of claim 27, wherein the third attribute data value range is between at least one of about 50 and about 127 and about -5 and about +5, the third attribute data value range being measured on a voxel scale between at least one of about 0 and about 255 and about -128 and about +127.

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29. The system of claim 28, wherein imaging the third set of voxels comprises the steps of:

selecting a voxel from the third set of voxels, the selected voxel representing a seed voxel;

autopicking voxels from the third set of voxels that are connected to the seed voxel and have the same data value; and

displaying the autopicked voxels from the third set of voxels to a user.

30. The system of claim 28, wherein imaging the third set of voxels comprises the steps of:

assigning a new data value to each voxel in the third set of voxels, the new data value having the same data value within a new data value range between about 0 and about 127;

selecting a voxel from the third set of voxels, the selected voxel representing a seed voxel;

autopicking voxels from the third set of voxels that are connected to the seed voxel and have the same data value; and

displaying the autopicked voxels from the third set of voxels to a user.

31. The system of claim 17, wherein imaging the first set of voxels and the second set of voxels comprises the steps of:

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combining the first set of voxels and the second set of voxels to form a combined set of voxels representing the preferred feature, each voxel in the combined set of voxels being assigned a new data value, the new data value having the same data value within a combined data value range between about 0 and about 127;

selecting a voxel from the combined set of voxels, the selected voxel representing a seed voxel;

autopicking voxels from the combined set of voxels that are connected to the seed voxel and have the same data value; and

displaying the autopicked voxels from the combined set of voxels to a user.

32. The system of claim 17, wherein imaging the first set of voxels and the second set of voxels comprises the steps of:

selecting a voxel from at least one of the first set of voxels and the second set of voxels, the selected voxel representing a seed voxel;

autopicking voxels from the first set of voxels that are connected to the seed voxel and have the same data value;

autopicking voxels from the second set of voxels that are connected to the seed voxel and have the same data value; and

displaying the autopicked voxels from the first set of voxels and the second set of voxels to a user.